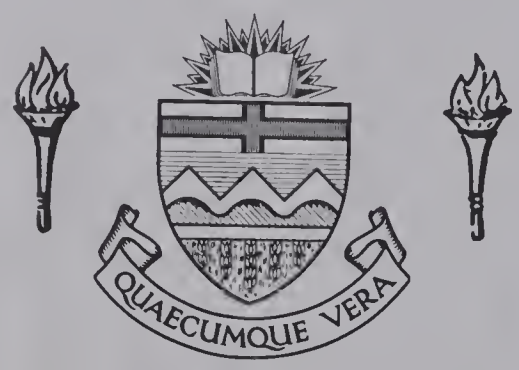

THE UNIVERSITY OF ALBERTA

A FURTHER STUDY OF TWO THEORIES CONCERNING NONINTELLECTIVE ATTRIBUTES NEGATIVELY RELATED TO PERFORMANCE IN BEGINNING READING

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "A further study of two theories concerning nonintellective attributes negatively related to performance in beginning reading" submitted by Nancy Frank in partial fulfillment of the requirements for the degree of Master of Education.

ABSTRACT

Two hypotheses are presented concerning the nonintellective attributes negatively related to the presence of word errors in beginning reading. The first hypothesis, stemming from some observations concerning nonverbal creativity, claims that this event can be attributed to the cluster of attributes: maleness, taciturnity, nonimpulsivity, and ease of conditioning to set. The second hypothesis, from Kagan's recent work, claims that the cluster of attributes should be maleness, talkativeness, impulsivity and resistance to conditioning of set. Two investigations with grade one children using the factorial method, revealed loadings supporting Kagan's hypothesis. If the other cluster of attributes represents a group of individuals, then presumably their number is too small to show up in the present factorial space.

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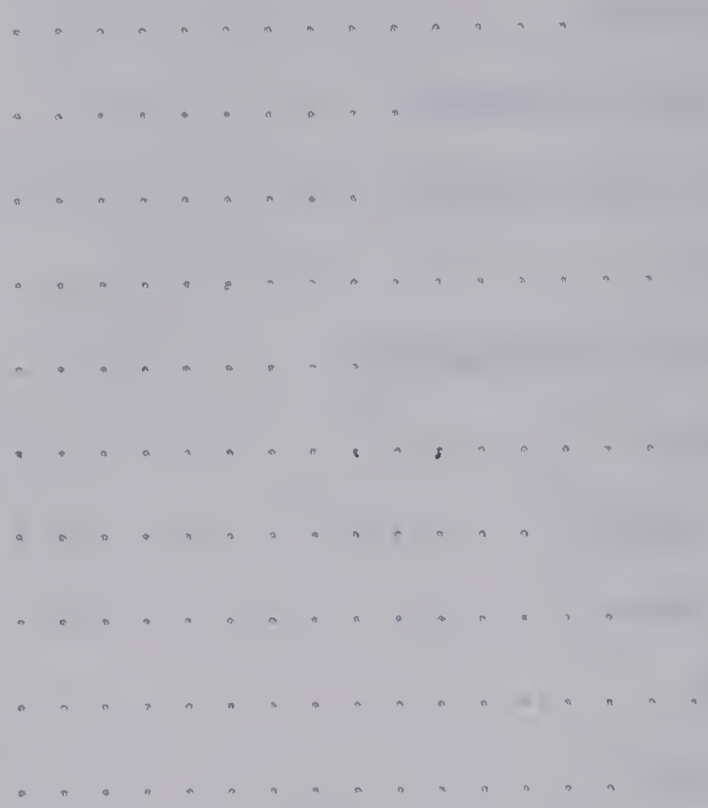

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CHAPTER I

INTRODUCTION

There are two reasons for investigating the case of children in the elementary school who perform relatively badly in verbal areas despite adequate intellective potential. Firstly, if teachers were aware that the quiet individuals who seem unable to learn have the capacity for problem-solving but are handicapped when it comes to memorization of verbal facts, perhaps for these students at least the emphasis in education would be shifted from a verbal, rote memory sort of learning to education in the solution of problems. One area that lends itself particularly well to the problem-solving approach is science, yet even here, the focus is more on rote memory than empirical and deductive thinking. One reason for this method of teaching is evident when one considers that relatively few teachers receive special training for science instruction. Only 58 students from all those in four undergraduate years and in programs for advanced diplomas reported science as their major field of study in the Faculty of Education, University of Alberta. From those 58, two were in secondary education, the rest in elementary (Hunka, 1966, p. 7).

Stanley (1959) in another study reported that of 92 students (89 women and three men) who were seniors in the elementary-education program at the University of Wisconsin during the

academic year of 1957-58, 26 per cent took neither physics nor chemistry in college, and of that percentage, only 8 went on to take college physics or chemistry. The majority, 47 per cent, elected to take chemistry only, with about one person in four taking a course in physics, and one in six taking a course in both physics and/or chemistry. Most teachers have academic orientations leaning heavily toward languages, the humanities, or the social sciences, and the need for science teachers is great. Many science courses are taught by teachers using methods adequate for students learning French vocabulary or conjugations, but which do not train problem-solving, either verbal or non-verbal.

Secondly, many leading scientists have expressed a distaste for language as a medium of precise communication (Koestler, 1964, pp. 169-177). The intent of the Royal Society's motto "Nullius in Verba" is clearly reflected in Sprat's proposal, published initially in 1667 and reprinted in Cope and Jones (1958), for the replacement of " ... the difficult doctrines of general arts (p. 329)" by practice and experiment in the education of youngsters. In the nineteenth century Maxwell, in a letter of 1858 reprinted by Campbell and Garnett (1882) writes: "I have observed that the practical cultivators of science ... have all a distinctness and freedom from the tyranny of words in dealing with questions of order, law ...(p. 305)." A similar view was held by Kelvin (Thompson, 1910, p. 117) and

Hadamard (1945, p. 225). In a paper originally published in 1918, Einstein (1954) talked of scientists as "... odd, uncommunicative, solitary fellows ... (p. 225)," and in a later protocol given by Hadamard (1945), remarked that "The psychic entities which seem to serve as elements in the thought ... are, in my case, of visual and some of muscular type (pp. 142-143)." Certain investigations lend support to this possibility that information may be processed in a nonverbal way.

CHAPTER II

THEORY AND HYPOTHESES

In their research on crossmodal transfer of form discrimination in preschool children, Blank, et al, (1968), showed that transfer involving the identical stimulus experienced in two modalities need not be language dependent. The preschool subjects were trained on discrimination problems in either the visual or touch modalities and were then given the same problem in the other modality. The discriminanda were three-dimentional geometric forms located over wells containing a candy reinforcement. The problems involved selection of the form, either visually or tactually, which was identical to that previously perceived in the opposite modality. Crossmodal transfer occurred only from the visual to tactual modality and was not assumed to be mediated by language because the children were unable to label the shapes used in the problems when questioned by the examiner. Blank concluded that the subjects retained a nonverbal representation of the object enabling him to solve the crossmodal problem.

Furth (1966) has also accumulated evidence in support of this hypothesis about nonverbal problem solving. He observes that language learning among the hearing does not demand a high level of intelligence (retarded children can learn it quite well) and, therefore, its lack

cannot of itself be the factor which retards problem-solving among the deaf. If the deaf subjects were to show an inferior performance to matched hearing controls on a thinking task, there had to be a factor, other than linguistic inadequacy, common to most deaf persons which related to the inferior performance. Twelve nonverbal experiments were devised in which linguistic competence was not assumed and verbalization was discouraged. Because of the ambiguity involved in nonverbal instructions, transfer-type tasks were used in which the introductory task was very simple, and the principle learned had to be applied to a new, more complex situation. Matched samples of deaf and hearing subjects ranging in age from four to fifty years participated in the research. The areas under study were labelled conceptual discovery and control, memory and perception, Piaget-type conservation, logical classification and verbal mediation.

Furth's characteristic findings, that deaf subjects performed remarkably like controls, can be illustrated from their responses to tests involving a reversal shift which is regarded, with some justification (Silverman, 1966), as a product of verbal mediation. Twelve hearing and twelve deaf children at each of ages four, five, six, seven and nine were given acquisition trials in which a reward was placed in double alternation fashion behind one of two doors. The success criterion was ten consecutive correct choices. In the first transfer task, the doors were replaced by two blocks and a light went on to indicate the correct response. Three further tasks were given in which changing dimensions to be disregarded by the

subject were included as interference. Only at ages five and six did the deaf perform less well than the hearing, with no difference at ages four, seven and nine. Furth's discussion of these and similar results from the other studies has a Piagetian flavor.

> Action is the source and medium of intelligence and the reality of concepts must be sought in the action of thinking which can become embodied in a symbolic medium. But human intelligence is neither tied to any particular type of internal images, nor to any particular type of symbols. (Furth, 1966, p. 197).[1]

Now, as this is the case, then certain individuals may not represent this unverbalized activity in words at the conscious level, and this absence of verbal practice may militate against their performance in beginning reading. A relatively accurate measure of their intellectual functioning might comprise some of Piaget's logical inclusion and classification tests which Vernon (1965, pp. 120-121) has shown to be negligibly loaded on educational and verbal factors.

What are the characteristics of these nonverbal people? A first likely attribute is taciturnity (Einstein, 1933, p. 10) (Hadamard, 1956, p. 75), presumably by parental reinforcement or

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[1] Two points may be advanced against the use of Furth's work in support of unverbalized activity. In the first place, occasionally he (1961) shows that deficits are to be observed in the case of concepts most dependent on language. In the second place, it could be argued that the present experiment listed does demonstrate the role of language in the reversal-shift, i.e. deaf children did perform less well than the hearing at ages five and six years; the reversal-shift experiment shows that this is when verbal mediation emerges in this type of task.

by the presence of parental models of taciturnity. A second attribute may be maleness. As Roe (1963, p. 133) has pointed out, teaching in the elementary schools is heavily verbal with an emphasis on rote learning to the exclusion of nonverbal problem-solving, a situation which, according to Kuhn (1963, p. 350) applies also to the teaching of science in the high school. Such a verbal emphasis will suit the female whose significantly superior elementary school performance (Watson, 1965, p. 396) is matched by an equally superior preschool verbal performance (ibid., pp. 331-332). Furthermore, competence in beginning reading requires the association of symbol and sound in accordance with the direction of the teacher, the kind of performance more likely to be obtained from the obedient and hard working female (Maccoby, 1967, pp. 27-28) who is receptive and tends to imitate external moral standards (Lynn, 1962, p. 559). The boy, on the other hand, who is markedly superior on tests both of verbal and nonverbal problem-solving (ibid., p. 561) and on the heavily nonverbal tests of spatial performance (Maccoby, 1967, p. 26) (Smith, 1965, pp. 209-210) performs less well at school because he internalizes his own moral standards rather than being highly responsive to those of others, i.e. his teachers (Lynn, 1962, p. 559). This

last point is emphasized by Rosenhan and White (1967, p. 430).[2]

Finally, the taciturnity of Couch and Keniston's (1960, pp. 167-168) "naysayers", compared to the talkative and impulsive "yeasayers", is associated with their greater acceptance of socializing pressures by parents (ibid., pp. 171-172) i.e. their greater conditionability, if Eysenck (1964, p. 80) is correct. An appropriate test of ease of conditioning, the spheres test, has been devised by Uznadze (1966). It is based upon the theory that repeated presentations of the same stimulus establishes in the subject a set, or conditioned readiness to perceive an object in a certain way as a function of previous experience (Uznadze, 1961, pp. 29-32) which is said to be fixated when it causes the learned response to be elicited in a similar situation. The number of presentations of the stimulus before set is fixated and the number of trials needed to extinguish it varies among individuals concomitantly with their sensitivity to conditioning. Uznadze found, as did Eysenck, that impulsive subjects do not

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2 The use of these traits associated with the culture of the Americas does not exclude the possibility, in the developing countries where education is necessary for advancement by males while females stay at home making objects with beads, that the emphasis of the socializing agencies so reinforces the male that he turns out to be superior in every aspect of the curriculum, verbal and nonverbal, and associated traits (Irvine, 1968).

condition well because they orient and adapt to many different aspects of the environment (Pribram, 1964, pp. 87-88). Norakidze (1966) aptly describes this "dynamic set" which

> ...contributes to the individual's adaptation to a complex and variable environment; it is incapable of protractedly and intensively resisting the environment by which it is being acted upon, nor of prevailing over it for any length of time. The factor of fixation subordinates itself to the environment and, receding into the background, enables the set to conform to the given situation and normally direct the adaptive activity under complex environmental conditions, in a conflictless way (p. 187).

Uznadze (1966) describes this group as extraversives. He talks of

> ...a completely distinctive group of subjects who in contrast to the other groups, never fall under the influence of the fixing experiments, never fix the set which arise in each individual case, and therefore, always gives the correct estimate of the size of the experimental objects. We see that the usual number of fixing exposures is inadequate for the production of a fixed set in these subjects, so that a new set arises as a result of each individual exposure. In this case, we are dealing with persons lacking in internal directing power, and apparently entirely under the control of outside impressions, and thus distinguished by their extreme extraversion (p. 49).

Bzhalava (1966) describes the contrast group as operating "... in compliance with the fixated set-impulse (p. 100); he has been able, as Appell said of Poincaré "...perdre la conscience du monde vulgaire (p. 89)." Accordingly, the present hypothesis is that the attributes of maleness, taciturnity and ease of conditioning will show a heavy loading on the nonverbal factor.

These predictions are at apparent odds with those stemming from

the work of Kagan (1965b, pp. 620-621) (1965a) (1966a) (1966b) (1968) who has shown that, in the case of the performances of grade 1 boys, impulsivity, defined as the making of very fast responses to problems of high response uncertainty without "... considering the differential validity of alternate answers (1966b, p. 583)" is correlated significantly with the tendency to make word errors of all kinds in reading. Furthermore, this impulsivity is associated with nontaciturnity (Couch and Keniston, 1960, p. 167-168) (Kagan, 1965a, p. 156) and a persistent orientation to the outside world (1960, p. 167) (1966b, p. 584) which will result in a resistance to conditioning in the sense that in the second signal system which is greatly used by talkative individuals, one-trial learning can be realized.

A First Investigation

A first investigation was carried out by Nicholson (1966), who tested 51 subjects in the first grade of a middle-class school in Edmonton, Alberta. The achievement of its pupils was generally considered to be above average, the average WISC performance score being 108. Nicholson's sample included 27 subjects (19 males and 8 females) from one class and 24 (15 males and 9 females) from another. Children had been randomly assigned to these classes at the beginning of the school year. Ages ranged from 6 years 3 months to 7 years 2 months, with the median and mean age at 6 years 8 months.

Tests

1. To establish the reading criterion, the Lee Clark First Reader Reading Test, Form A, was used. This group test was administered by each teacher to her own class, and was scored by the teachers.

2. Three Piagetian tasks[3] were administered to determine the children's level of performance in concrete operations. First, addition tasks were adapted from Piaget's experiment with flower pictures (Inhelder and Piaget, 1964, p. 101). Since logical addition is followed by acquisition of logical multiplication, two multiplicative operations were required, one based upon matrix tests (ibid., p. 159), and the other on class intersection (ibid., p. 176). Although Piaget refers to the former as "complete multiplication" and the latter

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[3] Constructed by M.M.N.

as "simple multiplication", he contends that the intersect is a more complicated process which involves abstracting a portion of the total system of the matrix (ibid., p. 177).

1. Classification tests

The first subtest involved the categorization of 20 pictures, upon which were flowers and 'other things.' Of the 16 flowers, eight were tulips--four being red and four being yellow. The 'other things' consisted of a bonnet, a banana, a horn and a fish. According to Piaget (Inhelder and Piaget, 1964, p. 101), the following class inclusion relationship could be established: A (yellow tulips) < B (tulips) < C (flowers) < D (flowers and other things).

In order to determine whether the child could grasp this relationship, each subject was given five minutes in which to spontaneously classify the cards. Instruction consisted of telling the child, "Here I have some pictures that are all mixed up. I want you to put them in piles of things that you think belong together." The examiner silently observed the subject, offering encouragement only when the child seemed quite unable to begin the task, and responded minimally to verbalizations of the subject.

Following the spontaneous classification task, the pictures were grouped correctly on the table and the child was told, "Here is a garden. If you pick all of the tulips in the garden, will you pick this one? (pointing to a red one)," as a test of comprehension of class inclusion. To test comprehension of quantification of inclusion, the

subject was asked:

a) Are there more yellow tulips or are there more tulips in the garden?
b) Are there more tulips or are there more flowers in the garden?
c) If you pick all the tulips, will there be any flowers left?
d) If you pick all the flowers, will there be any tulips left?

Next, the complete multiplication problems were presented in the form of matrices. First, a sample matrix was shown to the subject with the following verbal accompanyment:

"Look, here is a big green ball and a big green square; a little green ball, but the last picture is missing." Then, the child was told to find the missing picture from the selection of alternatives and to put it in the right place. The examiner positively reinforced the correct choice by saying, "That's right. Now, we have a big green ball and a big green square; a little green ball and a little green square. Or, we can see a big ball and a little ball; a big square and a little square." If the child was incorrect, the right item was chosen and the above explanation given.

For the following five matrices, the examiner said, "Look at all of these shapes (or pictures). Find the right one that goes in this space." After each selection, the child was asked why he chose that particular item and his answer was recorded.

The concept of simple multiplication was tested in a manner similar to that used by Piaget (ibid., pp. 176-178). Intersect problems were utilized, the first of which consisted of two rectangular cards with green pictures, which were placed perpendicularly to the child. He was then asked, "In what way are these pictures all the same?" If incorrect, the child was told that they were all green, and then the examiner separated the cards, saying, "Now, if I make a space here in the middle for one more picture, what sort of picture will go with all the others?" An incorrect answer was corrected, and a correct answer earned a point. When the green cards were removed, two other cards, this time with varicolored leaves were presented parallel to the child. He was then told, "All these pictures are the same. In what way are they the same?" "Yes (or no), they are all leaves. Now, if I make a space here, what picture (of the alternative items) will go with all the others?" Once again, incorrect answers were corrected, and correct answers earned a point. Then the green cards and the leaves were placed in the form of a cross with a space in the middle. The six alternative pictures were laid out while the examiner said,

> Now I'm going to put all the green things here and the leaves here so that there is a space in the middle. We have to find a picture for this space. Remember, the picture must go with all of these (pointing to the green pictures) and with all of these (pointing to the leaves).

Once the child had made a choice, the examiner questioned him as to why he chose the pictures, and his answer was recorded.

The cards were then modified to an L-shape, with the green pictures perpendicular and the leaves horizontal. A space was left just at the juncture of the two cards. The child was then asked to find the picture which went with both cards. The child's solution and answer as to why he chose it were again recorded. The green row and green alternatives were replaced by red ones, then yellow ones, each time the child being asked to pick from the alternatives and to explain his choice. The final problem consisted of the leaves remaining horizontal while each of the colored stimulus cards were placed perpendicularly side by side with a space beneath each for the suitable alternative. The subject was then asked:

> Now, can you find three pictures, one that goes with this and this (pointing to green pictures and leaves), one that goes with this and this (pointing to red pictures and leaves), and one that goes with this and this (pointing to yellow pictures and leaves).

As before, the child was required to explain his choice.

The examiner based the child's scores on correct selection and an indication of some understanding of the operations involved, received either from spontaneous verbalizations or direct questioning following each test item. Twelve points were possible for each subtest--addition, complete multiplication and simple multiplication. The total score possible was 36.

2. A set test was administered in the haptic modality, using three wooden spheres with handles. One sphere was 100 mm. in diameter, and the other two spheres were each 70 mm. in diameter, and

each of the three spheres weighed 300 gm.[4]

The subject was blindfolded and seated upon a chair with his hands, palms upward, resting on his thighs. The examiner explained, "I am going to give you two balls, one in each hand. You may hold them for a moment, then I'll take them away. I'll do this a few times and every time I give you the balls, I want you to tell me if they are the same size or if one is bigger." Upon each presentation, the examiner asked, "Are they the same size, or is one bigger," in order to make certain that the subject was concentrating on volume and not on weight.

Fixation of set was determined in the following way: the unequal spheres were presented twice, with the larger always placed in the right hand. The critical set occurred when the equal spheres were then presented. If the equal spheres appeared unequal, then the set had been fixated. If not, the series was repeated until the set was fixated, or until a maximum of seventeen setting trials had been presented.

After set had been established, the critical trials (presentation of equal spheres) were continued until the spheres were perceived as equal for five consecutive trials. A maximum of forty critical trials were presented in the extinction phase.

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4 The spheres test was borrowed from John Hritzuk of the University of Calgary.

4. A test to measure impulsivity-reflectivity was devised,[5] based upon Kagan's (1964) Matching Familiar Figures (MFF). Twelve charts 8½" x 11" were made, with seven simple ink drawings on each. The top picture, the stimulus, had to be matched perfectly with one of the six alternatives drawn below. The other five pictures had slight variations. Two of the charts served as samples and ten were test items.

The S was presented with Sample A standard figure and the corresponding chart with similar varients and told, "Look at the picture at the top. Can you find one just like it here?" (pointing to the other pictures). When the correct one had been located, the procedure was repeated with Sample B until the correct figure was chosen. Then the examiner said:

> "I will show you ten more cards. Each time I show you a card, look at the top picture first and find one just like it. I am going to use the stopwatch to see how long it takes you to find the correct one, but you may take as much time as you need to make sure. Only one of the pictures is exactly like the top one."

The ten charts were presented in order with no further instructions. Each response was scored and the time taken in seconds was recorded.

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[5] Kagan's own MFF test arrived too late to be used in the present investigation. The current version was constructed by M.M.N.

5. Verbal and performance IQ scores were obtained from the Wechsler Intelligence Scale for Children (WISC) which was administered, following standard instructions, to each subject by M.M.N. The digit span subtest standard scores were included because, whereas an immediate memorial capacity is required for the learning of verbal language units which occur over an appreciable span of seconds, this is not so true of nonverbal performance of a predominantly visual sort (Paivio, 1966).

6. A taciturnity measure was calculated by imposing a normal five-point scale on the teachers' rating of the students in order from the most talkative to the least. The ordering made by the teachers corresponded closely to that which would have been made by the author as a result of the individual testing interaction with each student, with the extremes being identical. That is, the children considered most talkative by the teachers would have been classified in the same manner by the author, and vice versa. The most taciturn were classified as 5 and the least as 1.

Results

The matrix of intercorrelations[6] was subjected to principal axes factor analysis (Householder's method). Six factors with latent roots greater than one were obtained and Table 1 shows

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[6] Matrices of intercorrelations will be found in Appendices A to C.

TABLE I

ROTATED FACTOR MATRIX - ORTHOGONAL FACTORS

Variable	I	II	III	IV	V	VI	h^2
1. Reading Auditory Stimuli	.839	.058	.089	.038	.096	.081	.733
2. Visual Stimuli	.835	.160	-.009	-.100	.018	-.143	.753
3. Following Directions	.821	.005	.149	.193	.050	.148	.759
4. Sentence Completion	.855	-.206	.018	.033	-.169	.000	.804
5. Making Inference	.819	.077	.100	-.151	-.049	.063	.716
6. Classification Addition	.549	.342	-.017	-.005	.092	-.117	.441
7. Matrix	.084	.818	-.047	.080	-.104	-.212	.740
8. Intersect	-.084	.546	.224	-.001	.177	.208	.431
9. WISC Verbal	.372	.242	-.064	-.003	-.586	.108	.556
10. WISC Performance	.193	.770	-.059	-.011	-.114	.211	.691
11. WISC Digit Span	.360	-.222	.140	-.678	-.144	.249	.741
12. Sex	.146	.026	-.145	.762	-.304	.103	.727
13. Age	.107	-.248	.221	.544	.446	.239	.673
14. MFF Time	.073	.114	-.079	-.076	.815	-.029	.695
15. Spheres Setting Trials	-.259	.006	-.826	-.025	-.005	.237	.807
16. Critical Trials	.005	.054	.900	-.148	-.017	.000	.836
17. Taciturnity	-.028	-.115	.191	-.030	.068	-.864	.803
Sums of Squares	4.204	1.954	1.727	1.445	1.431	1.145	11.906
% of Total Variance	24.7%	11.5%	10.2%	8.5%	8.5%	6.7%	70.0%
% of Common Variance	35.3%	16.4%	14.5%	12.1%	12.0%	9.6%	100.0%

these factors rotated according to the Varimax criterion for simple structure. The first factor is clearly a verbal one, being defined primarily by performance on the reading variables. The second factor is a nonverbal one, 80% of its common variance coming from performance on the matrix, intersect, and WISC performance. Set tests, both setting trials and, inversely, critical trials, comprised the third orthogonal factor. Factor four, the sex factor, took much of its variance from that variable, with digit span making a negative contribution, and age a moderately positive one for a total of 94.4%. In other words, a low digit span score was associated with males, particularly those who were older. Lengthy response time on the Matching Familiar Figures Test accounted for a good deal of the variance in the fifth factor, in association with low verbal WISC IQ, and some contribution from older children, particularly females, comprising 90.8% of the variance. Finally, the only significant loading on the sixth factor was taciturnity. It is clear from these results that the factor at the basis of the present investigations and with attributes at odds with Kagan's factor, is not supported because the nonverbal factor loadings of the spheres and taciturnity tests are negligible.

To offset the charge that Varimax rotations artificially destroys any relationship among the factors, the principal axes factors were subjected to an oblique Procrustes rotation. The

results are not reported here because they only served to define the factors more clearly and once again provide no support for the hypothesis.

In an attempt to increase the size of the loading for taciturnity and spheres tests on the second factor, another Varimax rotation was performed on the first two factors only (latent roots 4.431 and 2.056), the results appearing in Table II.

In the case of the second factor, again clearly a nonverbal one, loadings on the matrix, intersect and WISC Performance tests increases, particularly the last. Taciturnity has a moderate negative loading which implies nontaciturnity, the setting trials a moderate positive (.512) and the critical trials a moderate negative loading. In fact, then, the nonverbal males (sex has a loading of .399) represented by this factor are impulsive, talkative, conditioned with difficulty and extinguish set rapidly.

There is still the possibility, made plausible by occasional case studies and observations, that the psychometric impact of Kagan's dominant factor does not require the abandonment of the hypothesis that there exists a set of nonverbal boys who are taciturn, nonimpulsive and easy to condition. The real problem, then, is whether the number of the latter boys is sufficiently large to show up on the factorial screen. Clearly this cluster does not describe all boys who are, in the generality, more impulsive, less talkative, and more easy to condition than girls (Kagan,,1964, pp. 150-151), who are much more dependent on external

TABLE II

ROTATED FACTOR MATRIX - THREE ORTHOGONAL FACTORS

Variable	I	II	III
1. Reading Auditory Stimuli	.843	.084	.717
2. Visual Stimuli	.815	.096	.674
3. Following Directions	.813	.021	.661
4. Sentence Completion	.824	-.057	.682
5. Making Inference	.833	.028	.694
6. Classification Addition	.543	.221	.344
7. Matrix	.145	.602	.383
8. Intersect	.007	.243	.059
9. WISC Verbal	.428	.415	.355
10. WISC Performance	.259	.625	.498
11. WISC Digit Span	.418	-.281	.254
12. Sex	.101	.397	.168
13. Age	.061	-.241	.062
14. MFF Time	-.017	-.131	.017
15. Spheres Setting Trials	-.429	.512	.446
16. Critical Trials	.225	-.506	.307
17. Taciturnity	-.022	-.408	.167
Sums of Squares	4.397	2.090	6.487
% of Total Variance	25.9%	12.3%	38.2%
% of Common Variance	67.8%	32.2%	100.0%

sanctions than their male counterparts (Rosenhan and White, 1967, p. 430). Whether the less representative factor, comprising the polar opposite attributes can be revealed by the factorial approach based on intercorrelations among the performances of a different sample on different tests, is a matter for further study.

A Second Investigation

Occasional case studies, introspections and plausible inference from experimental and psychometric investigations make it difficult to abandon the other factor representing a set of people characterized by non-impulsivity, taciturnity and maleness. To lend greater probability to the appearance of this factor, certain changes were made in the second investigation. The first was the use of a sample with a much greater variance of intellectual performance, the WISC performance standard deviation in the previous sample being 10.0, the Raven, in the current one, being 16.0. The second was the replacement of the WISC, which took longer to administer than its loadings on the first factor warranted but nevertheless loaded highly on the second or nonverbal factor, by Raven's Colored Matrices. The third change was the use of the proper version of Kagan's MFF test in place of the locally-constructed version which proved too difficult for the children, and the fourth was the addition of two variables stemming from the theory, father's occupation and birth-order. The former variable is known to be negatively related to taciturnity (Nash, 1965, p. 276) and birth-order has been found to be associated with the encouragement of dependence (Carrigan and Julian, 1966), particularly by the interfering parent (Hilton, 1966), for whom dependence probably and often implies silence and social isolation.

Method

Subjects

Out of a group of 174 children from first grade classrooms of three elementary schools in Edmonton, Alberta, 68 subjects (35 females and 33 males), estimated as having a Raven IQ of 108 or above, were selected for further testing. Ages ranged from 78 months, with a mean age of 80.6 months at the time of final testing.

Tests

1. The Raven Colored Progressive Matrices was used to establish the intellectual level of the child. This is generally regarded as a nonverbally oriented, culture-free test and was chosen as a substitute for the WISC performance scale. This test was administered to groups of six to eight children.

Once the children had been categorized intellectually, and the brighter ones chosen as subjects for further investigation, the following battery was administered individually: the Piagetian nonverbal tests, Uznadze's spheres test and Kagan's MFF. The Gates-McGinite Reading Test, Form A, was used to measure reading ability. This test, yielding scores in vocabulary and comprehension, was administered in a group setting by the classroom teacher and scored by her.

Five further measures completed the battery: birth-order and father's occupation were obtained from the cumulative record.

Occupations were divided into three groups: professional-technical, which included farmers, managers, officials and proprietors; clerical-sales, including craftsmen and foremen; and laborers. These groups were rated 0, 1, and 2 respectively.

A measure of taciturnity was obtained by presenting the teachers with a list of their students, and asking them to rate the children along a continuum of 1 to 5, the most taciturn being rated as 1 and the least as 5, the precautionary conditions for the simple validation of the variable being carried out after Nicholson's fashion.

CHAPTER III

RESULTS

As before, principal axes factors were rotated to a varimax criterion, five factors appearing. On the first factor, the significant loadings, all positive, are for the verbal, non-verbal, taciturnity (talkative) and MFF (small error) variables. This factor might be labelled need for achievement and resulting all-round academic performance. The salient loadings on the second factor are for occupation (higher), a long latency, a small number of errors and high verbal performance. The third factor approximates Kagan's with its clear evidence of impulsivity or ease of conditioning on Uznadze's test (setting trials .781; critical trials .854), of high nonverbality and correspondingly low verbality. Against this interpretation is a point to be treated in the discussion: the fact that the loadings on the two MFF variables are negligible. The last two factors are obscure and do not relate to the hypothesis under study.

An analysis of the intercorrelations for males and females was made on the expectation that any sex differences would cause the factors to stand out more sharply in terms of the loadings, because the number of significant factors would be fewer. The factor loadings for males are presented in Table IV. The large

TABLE III

ROTATED FACTOR MATRIX - ORTHOGONAL FACTORS

Variables	I	II	III	IV	V	h^2
1. IQ	-.077	.202	.048	.222	-.635	.502
2. Age	-.107	.185	.004	.009	.690	.521
3. Occupation	-.137	-.679	-.072	.293	-.019	.571
4. Birth Order	.090	-.213	.074	.636	.005	.463
5. Taciturnity	.402	-.060	-.146	.166	.095	.583
6. Addition	.070	.208	.213	.487	.220	.379
7. Matrices	-.136	.140	-.106	.526	-.211	.370
8. Intercept	.787	-.095	.326	-.055	-.203	.779
9. Total	.743	.080	.367	.386	-.113	.854
10. Spheres Setting Trials	-.027	.025	.781	-.052	.113	.626
11. Spheres Critical Trials	-.066	-.081	-.854	.001	-.029	.740
12. MFF Errors	-.342	-.547	-.003	-.427	.106	.609
13. MFF Latency	.104	.829	.074	.282	-.163	.810
14. Vocabulary	.756	.414	-.302	-.071	.092	.848
15. Comprehension	.744	.352	-.341	-.041	.086	.803
Sums of Squares	2.501	1.969	1.889	1.484	1.435	9.278
% of Total Variance	16.7%	13.1%	12.6%	9.9%	9.6%	61.8%
% of Common Variance	26.9%	21.2%	20.3%	16.0%	15.5%	100.0%

TABLE IV

VARIMAX ROTATION - MALES

Variables	I	II	III	IV	V	h^2
1. IQ	-.100	-.187	.792	.144	-.089	.701
2. Age	-.039	.088	-.185	-.717	.243	.616
3. Occupation	-.269	.006	-.165	.732	.007	.642
4. Birth Order	.374	-.007	-.226	.376	.544	.629
5. Taciturnity	.095	-.037	.073	-.233	.751	.635
6. Addition	.413	.130	.232	-.084	.009	.248
7. Matrices	.552	.170	.379	.520	.250	.810
8. Intercept	.498	.411	-.042	-.133	-.654	.864
9. Total	.759	.399	.262	.190	-.268	.912
10. Spheres Setting Trials	.780	-.038	-.089	-.173	.204	.689
11. Spheres Critical Trials	-.834	.047	-.037	.031	-.008	.700
12. MFF Errors	-.368	-.462	-.592	-.171	-.160	.754
13. MFF Latency	.315	.269	.715	-.293	.049	.771
14. Vocabulary	.021	.944	.037	-.105	-.065	.908
15. Comprehension	.070	.908	.020	.033	-.095	.840
Sums of Squares	3.076	2.423	1.886	1.756	1.579	10.720
% of Total Variance	20.5%	16.2%	12.6%	11.7%	10.5%	71.5%
% of Common Variance	28.7%	22.6%	17.6%	16.4%	14.7%	100.0%

and moderate loadings on the first factor indicates that this represents Kagan's cluster of attributes. The loading on nonverbality (total) is high, verbality insignificant; setting trials is high (conditioning takes a long time) and critical trials very low (conditioning is extinguished very quickly). Two other modest loadings are consonant with this factor. Occupation (-.269) slightly higher and birth order (.374) later i.e. the younger of superior socioeconomic status are likely to be more permissively treated for wild and impulsive behavior. Once again the MFF variables militate against this interpretation of the factor as supporting Kagan, the latency being moderately long and the errors few.

The second factor, loading highly on verbal and especially nonverbal variables with moderate latency and small errors, is difficult to interpret. The third factor, with heavy loadings on IQ, long latency, few errors, and a modest one on nonverbality and negligible ones on verbality presumably represents the slow and careful individual. The fourth factor could be claimed as referring to the young (-.717), middle-class (.732), laterborn, impulsive (setting trials -.173; critical trials .031; latency -.293 and errors -.171) individual whose impulsive and non-academic behavior may be tolerated by parents. The fifth factor is theoretically meaningless.

A similar analysis of the factor loadings for females was made. The first factor is a picture of a middle-class female, hard-working (latency .530, errors -.474), slightly introverted and nonimpulsive (setting trials -.275; critical trials .146), with strong verbal gifts (vocabulary .829; comprehension .827) as compared with nonverbal (.218). The third factor has a dominant loading on introversion or nonimpulsivity (setting trials -.786; critical trials .824), with lesser ones on birth order (laterborns), and few errors on the MFF test. The fourth factor carries heavy loadings on IQ (duller), age (older), birth order (relatively first-borns), nontaciturnity, low latency (relatively speedy), and a large number of errors. In terms of the MFF (latency and error) loadings, this is the closest to Kagan's factor that can be found in the present investigation; although, the important set and verbal variables certainly do not make the kind of contribution demanded by Kagan's hypothesis. The fifth factor does not carry any very obvious interpretation.

TABLE V

VARIMAX ROTATION - FEMALES

Variables	I	II	III	IV	V	h^2
1. IQ	.019	.470	.152	-.438	.323	.542
2. Age	-.106	-.006	.224	.454	-.017	.268
3. Occupation	-.763	-.010	.107	.214	-.273	.715
4. Birth Order	-.288	.290	.532	-.490	-.180	.722
5. Taciturnity	-.113	.162	-.033	.883	.024	.820
6. Addition	-.032	.125	-.023	.041	.735	.559
7. Matrices	-.049	-.146	.354	-.108	.544	.456
8. Intercept	.100	.916	-.063	.102	-.136	.881
9. Total	.218	.893	.036	.046	.133	.866
10. Spheres Setting Trials	-.275	-.030	-.786	-.034	-.049	.698
11. Spheres Critical Trials	.146	-.042	.824	.097	.183	.745
12. MFF Errors	-.474	-.068	-.366	.423	.274	.617
13. MFF Latency	.530	-.028	.127	-.561	.200	.652
14. Vocabulary	.829	.282	.182	-.106	-.210	.856
15. Comprehension	.827	.175	.301	.027	-.214	.852
Sums of Squares	2.725	2.125	2.070	2.005	1.326	10.250
% of Total Variance	18.2%	14.2%	13.8%	13.4%	8.8%	68.3%
% of Common Variance	26.6%	20.7%	20.2%	19.6%	12.9%	100.0%

CHAPTER IV

DISCUSSION

From the present investigations, support can be claimed for Kagan's hypothesis, that impulsive individuals, particularly males, are far too much oriented to the salient cues of the environment (Couch and Keniston, 1960, p. 22) or integrated dimensions to assimilate accurately verbal material, particularly that involving the composition or meaningful rearrangement of words (Luria, 1966, p. 323) and logico-grammatical structure (ibid., p. 320). The present support claimed for Kagan's hypothesis, reflected in the second factor of the total analysis and in the third factor in the analysis for females, is peculiar in that it relies for a measure of impulsivity on Uznadze's set test, and not on the MFF test, on the basis of which Kagan (1965) established his hypothesis. Indeed the correlations among the two tests are so insignificant that some consideration must be given to what these two tests, with their independent relationship and yet similar content validity, do in fact measure.

There are statistical and conceptual points to be made against Kagan's test. Firstly, he (1965a, p. 144) notes a significantly, and at least consistently, negative correlation between errors and response times on tasks like the MFF. This is certainly the case

with the present subjects for whose performance the correlation is -.612, for males -.650 and for females -.553. However, despite this, Kagan, Pearson and Welch (1966a) showed that reflexive training had a marked effect on response delay (inhibition of a fast response) but a negligible effect on errors or quality of performance. This unusual statistical effect is replicated when children taught by experienced reflective (nonimpulsive) teachers showed a greater increase in response time over the year than did all other children, but error scores were not influenced appreciably (1968, p. 33). This effect is all the more unusual conceptually, since the relationship between speed and accuracy of response in problem situations with high response uncertainty " ... holds because the tasks are sufficiently difficult to insure that children who respond quickly will be inaccurate (1965a, p. 144)."

Part of Kagan's problems is the fact that he (1968, p. 34) assumes that the reflective teaching resembles the modeling effects described by Bandura and Walters (1963, p. 82). However, this is not the case since he uses no post-experimental criterion that modeling effects have indeed occurred. Accordingly, it could very well be that, in terms of the latency measure, the children followed the teacher's behavior because this event was a source of reinforcement which, however, had no effect on the intellectual

skill determining error rate. Another speculative account of Kagan's problem is that the MFF latency score is a measure of risk-taking as well as impulsivity, that the risk-taking is uncorrelated with error scores and yet yields to reflective training.[7]

An attempt can be made, using the data in the second investigation, to replicate some of Kagan's findings from the MFF. Kagan (1965a, p. 141) reports a median correlation between response time and verbal ability as .19; the present two correlations for the total group are .326 (vocabulary) and .286 (comprehension) with a decrease for males to .273 and .224, and an increase for females to .385 and .358. By contrast, the MFF error score and vocabulary and comprehension show significant and negative correlations, especially in the case of females where the two correlations run -.551 and -.456. On the other hand, Kagan (1966a, p. 151) reports word recognition errors were related to recoginition errors on MFF by positive and significant correlations ranging from .31 to .55. Here the negative correlations make sense (MFF errors are negatively correlated with MFF response time; the latter is positively correlated with verbal abilities, hence, errors must be negatively correlated with verbal abilities) whereas, the positive correlations do not.

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[7] Kagan's (1968, p. 33) account of this lack of change in MFF error performance in line with the change in latency performance, with which it is sizeably and negatively correlated, is merely assertive and redundant.

Some striking support for the concept of set as representing a brain mechanism has appeared. While the Russians have not as yet any psychometric study of the set tests in any modality, nevertheless, they have demonstrated the power of the mechanism labelled "set" by showing how, once induced, it can help to direct behavior. For example, Khojava (1966, pp. 80-81) decided to find out how set manifests itself in reading and writing skills. His academic (presumably Kagan's reflective) subjects could read and write different European languages. To them he exposed tachistoscopically for 0.20 seconds each, 25 handwritten Latin characters such as zidel, tifal, duba, cytol and so forth, which the subjects read as soon as they appeared. These same subjects were then shown 25 handwritten familiar Russian words consisting of "neutral" letters similar to some letters of the Latin cursive script. Forty-five percent of the subjects read the first Russian words according to the Latin transcription and, as before, switching completely over to reading in Russian, some pronounced the words in a mixed way, some in Russian, some in Latin. Khojava explains this phenomenon in terms of the fact that the preliminary reading in Latin (setting trials) makes the subject read (critical trials) in accordance with "...the involuntarily emerging new modified mental state of directedness... (p. 84)." In another experiment, subjects were asked to write in Latin characters 15 German words to the experimenter's dictation (fenster, piltz, vernor , etc.) after which they were asked to

write with the right foot (to draw it in outline with his big toe) the next word pronounced. This was a Russian word which, under the influence of the set for Latin writing, lost its Russian meaning and was written by some of the subjects in Latin (ibid., p. 86).

This experimental change of set, is functionally and transiently equivalent to the disposition of impulsivity with which it shares a focussing on the salient cues of the external world. The set test has simple construct validity in that its setting trials induce an external set, the holding power of which can be measured and the critical trials allow the extent of the transfer of the set to be assessed. Whether the set test, as compared with Kagan's MFF test, is a more reliable and valid representation of the gradient running from orientation to the external world to that of "internal processes" is still to be decided. However, the psychometric oddities of the MFF and the conceptual strength associated with the concept "set" must allow the claim to stand strongly that Kagan's factor has been supported in the present two investigations.

As for the non-appearance of the hypothesis which activated the current investigations, the argument can be advanced that that hypothesis refers only to individuals who are potentially creative, in Maltzman's (1960) sense and who fall into the category of taciturn, non-impulsive individuals who are easily conditioned and relatively

impaired verbally. If this is the case, then a fair guess is that the number of these individuals is too small to have any psychometric impact, and that only a more clinical and descriptively statistical investigation would cast any light on the mode of their upbringing and on any verbal mishaps they may suffer in the elementary school.

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APPENDIX

APPENDIX A: CORRELATION MATRIX

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. IQ	1.00	-.201	-.054	.019	-.087	.021	.170	.120	.166	-.080	.056	-.178	.259	-.054	-.054
2. Age		1.00	-.018	-.083	.218	.019	-.033	-.058	-.075	.040	-.007	.034	.045	.029	-.043
3. Occupation			1.00	.119	.039	-.142	.092	-.126	-.142	-.039	.015	.118	-.398	-.305	-.266
4. Birth Order				1.00	-.061	.095	.040	-.052	.150	.014	.016	-.191	.033	-.024	.011
5. Taciturnity					1.00	.071	-.074	-.062	.013	.108	-.060	.106	-.174	-.134	-.094
6. Addition						1.00	.068	.017	.362	.052	-.117	-.117	.208	.033	.037
7. Matrices							1.00	-.068	.153	-.017	.106	-.127	.207	-.020	.007
8. Intercept								1.00	.759	.084	-.226	-.142	.105	.353	.305
9. Total									1.00	.155	-.266	-.399	.291	.377	.352
10. Spheres: Setting Trials										1.00	-.583	.029	.006	-.107	-.142
11. Critical Trials											1.00	.170	-.129	.127	.136
12. MFF Errors												1.00	-.612	-.450	-.394
13. MFF Latency													1.00	.326	.286
14. Vocabulary														1.00	.856
15. Comprehension															1.00

APPENDIX B : CORRELATION MATRIX - MALES

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. IQ	1.00	-.224	-.012	-.111	-.046	.040	.231	-.084	.092	-.045	.047	-.234	.313	-.089	-.051
2. Age		1.00	-.215	-.083	.146	.016	-.337	-.036	-.212	.135	-.021	.122	.141	.118	-.049
3. Occupation			1.00	.143	-.181	-.122	.152	-.261	-.115	-.319	.134	.031	-.329	-.109	-.056
4. Birth Order				1.00	.158	.112	.328	-.172	.114	.321	-.203	-.144	-.045	-.082	-.024
5. Taciturnity					1.00	.080	.153	-.315	-.087	.195	-.108	-.069	.048	-.061	-.087
6. Addition						1.00	.173	.147	.497	.127	-.284	-.223	.320	.116	.151
7. Matrices							1.00	.075	.676	.389	-.386	-.592	.316	.124	.169
8. Intercept								1.00	.723	.228	-.354	-.232	.236	.440	.425
9. Total									1.00	.407	-.533	-.556	.429	.386	.413
10. Spheres: Setting Trials										1.00	-.571	-.165	.209	.042	.066
11. Critical Trials											1.00	.379	-.284	.013	-.051
12. MFF Errors												1.00	-.650	-.401	-.363
13. MFF Latency													1.00	.273	.224
14. Vocabulary														1.00	.832
15. Comprehension															1.00

APPENDIX C: CORRELATION MATRIX - FEMALES

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. IQ	1.00	-.094	-.208	.216	-.253	.082	.165	.323	.281	-.133	.171	-.144	.270	.171	.078
2. Age		1.00	.208	-.088	.337	-.006	.075	-.049	.061	-.056	-.024	-.086	-.091	-.125	-.089
3. Occupation			1.00	.100	.250	-.145	.075	-.022	-.171	.228	-.087	.246	-.475	-.493	-.475
4. Birth Order				1.00	-.308	.072	-.041	.077	.187	-.301	.266	-.277	.130	.037	.048
5. Taciturnity					1.00	.087	-.183	.189	.116	.018	.022	.401	-.455	-.187	-.066
6. Addition						1.00	.064	-.105	.223	-.032	.065	.082	.043	-.113	-.150
7. Matrices							1.00	-.142	.022	-.140	.315	.026	.235	-.047	-.022
8. Intercept								1.00	.801	-.056	-.063	-.028	-.034	.320	.225
9. Total									1.00	-.083	.018	-.193	.137	.388	.302
10. Spheres: Setting Trials										1.00	-.607	.333	-.235	-.277	-.385
11. Critical Trials											1.00	-.171	.059	.230	.340
12. MFF Errors												1.00	-.553	-.551	-.456
13. MFF Latency													1.00	.385	.358
14. Vocabulary														1.00	.876
15. Comprehension															1.00